The Effects of Private Labels and Vertical Contracts on Collusion Damages: Evidence from the Canned Tuna Industry *

EXTENDED ABSTRACT - PLEASE DO NOT CITE OR CIRCULATE

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Abstract

This paper uses data from the Nielsen-Kilts database. Circulating our results requires clearance by the Kilts center, which we have not obtained for the most recent results yet. Therefore, we submit this extended abstract instead of a paper with our full results. We expect to obtain approval by Nielsen well before the IIOC so that we will be able to present our results. We analyze a recent collusion case in the US canned tuna industry using the Nielsen scanner dataset from 2006 to 2016. By combining a structural industry model and non-nested model tests (Rivers and Vuong, 2002), we provide detailed empirical evidence on the extent of the cartel. We highlight that it is crucial to take into account the vertical relations between manufacturers and retailers as well as the strategic pricing of private labels by supermarkets in order to correctly assess the damages caused by the cartel. Among others, our empirical results support the claim that there was a change in manufacturer conduct during our sample period.

Keywords: Collusion damages, non-nested model tests, differentiated products markets, vertical relations.

JEL Classification: L11, L41, C51.

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1 Introduction

Collusion among manufacturing firms is a widespread concern in many industries. Collusive behavior can lead to higher prices for both downstream firms and final consumers, which is likely to harm the efficiency of markets and reduce consumer surplus. In this context, a key difficulty is to distinguish collusive behavior from alternative explanations such as an increase in marginal costs or changes in demand. All three factors (firm conduct, marginal costs, and consumer demand) determine the magnitude of manufacturer margins; therefore, suspicious price movements per se are naturally not sufficient for establishing collusion. In many consumer packaged goods (CPG) industries, retailers not only distribute national brands (NB) but also sell their own private label brands (PL). Moreover, contracts between manufacturers and retailers are often nonlinear tariff schemes. With such a more complicated industry structure, testing for collusion and determining the associated damages becomes much more involved.

This paper makes two contributions. First, we provide detailed insights on a recent collusion case in the canned tuna industry in the US. While the Department of Justice (DOJ) has established the presence of a cartel among national brand manufacturers in the market for canned tuna from 2011 to 2013, several retailers claim that the extent of collusive manufacturer pricing was significantly larger than what the DOJ established.

We shed light on this important policy debate by applying non-nested model tests based on Rivers and Vuong (2002) to a detailed scanner data set on the canned tuna industry from 2006 to 2016. In contrast to many other collusion studies, we analyze a vast range of supply models that differ in both their horizontal and their vertical characteristics. Among others, we analyze whether the cartel covered all firms, retailers, and geographical markets or only a subset of these. Moreover, we allow for a rich set of nonlinear contracts between manufacturers and retailers, similar in spirit to Bonnet and Dubois (2010). Finally, we conduct our tests for 3 different subperiods of our data to investigate whether manufacturer pricing exhibits structural break over time.

Second, we use our industry model and the test results to provide more general insights about the importance of carefully considering the vertical relations structure in CPG industries when evaluating collusion damages. Most of the damage calculation in practice follows a very simplistic approach that ignores the complex structure of a typical manufacturer-retailer interaction.[1] A typical approach in damage calculation assumes that manufacturers sell directly to consumers, or if retailers exist, they charge a fixed margin over all products. We highlight in a series of counterfactual simulations that this approach can lead to a substan-

[1] See for example Verboven and Dijk (2009), Basso and Ross (2010) and Boone and Müller (2012).

tial mismeasurement of collusion damages. The reason for this is that nonlinear contracts can often mimic collusive pricing, in the sense that they can be equivalent or come close to joint-profit maximization.

Another key feature of CPG industries is that retailers offer both national brands and private label products. It is theoretically not clear how retailers will adjust the prices of their private label products when faced with higher wholesale prices for national brands (or higher retail prices under resale price maintenance (RPM)). However, it is very conceivable that the presence of private label products mitigates retailers' losses from collusive manufacturer pricing by providing an umbrella for prices of private label products. Using the estimates of our model, we analyze the magnitude of these channels for the canned tuna industry in additional counterfactuals. Specifically, we simulate prices of national brands and private label products if either private label products or manufacturer collusion were eliminated.

To the best of our knowledge, we are the first to use a full structural industry model to evaluate the interaction between collusion among NB manufacturers, nonlinear vertical contracts, and the presence of private labels for damage calculations.

Related literature This paper relates to several strands of literature. Methodology-wise, Bonnet and Dubois (2010) also employ Rivers-Vuong tests to provide empirical evidence on the prevailing vertical contracts between manufacturers and retailers. This approach is based on using statistical goodness-of-fit tests given the recovered price-cost margins under different supply model assumptions. They find that in the market for bottled water in France two-part tariff contracts with resale price maintenance best rationalize the data. Our demand side estimation builds on the seminal papers by Berry *et al.* (1995) (BLP) on estimating differentiated products demand.

Moreover, our paper is related to a literature on analyzing the interplay between private label brands and national manufacturer brands. Hansen *et al.* (2006) explores consumers' private label purchasing behavior across industries. Meza and Sudhir (2010) assess how the existence of private label products changes the bargaining behavior between a supermarket retailer and manufacturers. Cohen and Cotterill (2011) studies the impact of private labels on national brands in Boston's white fluid milk market. They find that the presence of private labels increases channel profits, retailer profits, and consumer welfare. Overall, this strand of research finds an inconclusive impact on retailer prices. Bonnet and Bouamra-Mechemache (2019) analyze the effects of a cartel among PL producers of yogurt in France using a bargaining model. In contrast to their paper, we study a cartel among NB manufacturers in the US where collusion occurred in a different market segment (NB instead of PL as in Bonnet and Bouamra-Mechemache (2019)). Modeling-wise, we do not employ a bargaining framework because tractable bargaining models are typically restricted to linear pricing models. A key focus of your study is on the implications of nonlinear pricing strategies on potential umbrella effects and their effects on damage calculation; therefore, we analyze a broad range of more classical supply models of vertical contracts between manufacturers and retailers.

Finally, there are several studies that explore the canned tuna industry, see, for example, Chevalier *et al.* (2003), Babula and Corey Jr (2004), Nevo and Hatzitaskos (2005), Liu (2007), and Sun *et al.* (2017). Chevalier *et al.* (2003) find that canned tuna prices decrease during periods of high demand, which can be explained by a loss-leader hypothesis. Nevo and Hatzitaskos (2005) contrast that during high demand periods consumers tend to be more sensitive to prices and thus switch their consumption to cheaper brands. Liu (2007) finds no significant stockpiling by consumer regarding canned tuna. Furthermore, market expansion dominates brand switching during sales periods while price promotions are likely related to retail competition. Babula and Corey Jr (2004) find differences in elasticities between imported and domestic brands. Moreover, canned tuna is complementary with bread and substitute with ground meat. Finally, Sun *et al.* (2017) finds that demand for tuna depends on the tuna species, retailer outlet (natural foods or conventional supermarkets) and whether or nor are certified as eco-friendly.

2 Data and Industry Background

2.1 Data and Industry Background

We use data from the Kilts-Nielsen database on the canned tuna industry in the US from 2006 to 2016, more specifically the retail scanner panel (RMS) and the consumer panel (HMS). The retail scanner panel records weekly prices, quantities sold, and various product characteristics for millions of products (UPCs) sold in over $35,000$ stores in the US. We restrict the data to 20 different geographic regions and 8 retailers.[2] We aggregate the data from the store-week level to the region-quarter level. The consumer panel covers purchase transactions of a representative sample of over $60,000$ consumers located in different geographic regions. We use this data to obtain demographic characteristics of the households in a given region.

In our sample period, the industry consists of 3 large nationwide manufacturers, which we refer to as firm 1, firm 2, and firm 3. Although market shares vary, the industry structure is relatively stable. The 3 national manufacturers cover around $80-84\%$ of the market. The remainder of the shares are attributable to private labels. No important new firms enter the

[2] A region is defined according to the Scantrack Market Code, a geographic definition similar to a Metropolitan Statistical Area (MSA). Nielsen does not provide the identity of retailers, therefore these are listed as coded in the data.

market during our sample period.

2.2 Descriptive Statistics and Reduced Form Evidence

This section still requires approval by Kilts-Nielsen.

2.3 Description of Collusion Case

During the review of a proposed merger between Chicken of the Sea and Bumblebee[3], a parallel investigation by the DOJ started investigating the possible existence of collusion on the market.[4] Eventually, Chicken of the Sea decided to cancel the merger in December 2015.[5] As the collusive investigation progressed, Bumble Bee and Starkist signed guilty pleas with the DOJ in May 2017 and October 2018. As established in the guilty pleas, both firms revealed that they conspired to fix, raise, and maintain the prices of packaged seafood sold in the United States between the first quarter of 2011 and the last quarter of 2013.[6] Chicken of the Sea, one of the three major NB firms in the US market, confirmed that it applied for Type B Leniency.[7]

While the DOJ has established the collusive period as occurring between 2011 and 2013, retailers have claimed that collusion has been recurrent as early as 2004.[8] This motivate us to explore the data in detail in order to analyze this claim.

3 Modeling framework

We model the canned tuna market using a structural industry model that consists of a random-coefficient differentiated products demand model and an oligopolistic pricing model for tuna manufacturers and supermarket retailers.

[3] By the end of 2014, Chicken of the Sea, decided to acquire 100% of the shares of its rival firm Bumble Bee by financing it through a share offering. The deal was expected to be finalized in the second half of 2015 conditional on the approval by the DOJ.

[4] Source: https://www.undercurrentnews.com/2015/07/23/thai-union-suspends-share-offering-to-finance-bumble-bee-deal-amid-doj-antitrust-probe/

[5] Source: https://www.undercurrentnews.com/2015/12/04/thai-union-steadfast-on-8bn-turnover-target-after-bumble-bee-deal-collapses/

[6] Source: https://www.justice.gov/opa/pr/bumble-bee-agrees-plead-guilty-price-fixing; https://www.justice.gov/opa/pr/starkist-co-agrees-plead-guilty-price-fixing. The actual dates of the conduct according to the guilty please differ: Bumble Bee (2011Q1 - 2013Q4) and Starkist (2011Nov - 2013Dec). As they do not differ by many months and as the actual dates are unknown we will assume the intersection of both periods. Therefore we will assume 2011Nov - 2013Dec.

[7] Type B Leniency refers to granting leniency while an investigation is on course. Source: https://www.undercurrentnews.com/2017/09/11/thai-union-confirms-its-whistleblower-in-us-tuna-price-fixing-probe/. The webpage refers to Thai Union, which is the owner of Chicken of the Sea.

[8] Source: https://www.undercurrentnews.com/2017/09/11/tuna-class-action-suits-delayed-again-as-doj-probe-continues/

3.1 Demand Model

We specify a random coefficient logit model to estimate consumer demand following the seminal framework by Berry *et al.* (1995). There are J_t brands available in each market (with $\tilde{J}_t$ being the total number of private labels available in each market). We define a market t as a region-quarter combination. Each market consists of a continuum of consumers. Individual i's indirect utility from consuming product j in market t is given by

$$u_{ijt} = x_j\beta_i + \alpha_i p^r_{jt} + \xi_{jt} + \epsilon_{ijt} \ , \ j = 1, ..., J_t; t = 1, ..., T \tag{1}$$

where x_j denotes a $K-$dimensional vector of brand j's observable characteristics (including several layers of fixed effects), p^r_{jt} denotes the retail price of product j in the market t, and ξ_{jt} is a brand-market specific quality shock that is unobservable to the researcher but observable to and equally valued by all consumers. As in Nevo (2001), the inclusion of fixed effects allows us to decompose ξ_{jt} into a time-invariant part that is captured by the fixed effects and an idiosyncratic component: $\xi = \bar{\xi} + \Delta\xi$. Thus, only the latter term is treated as our structural demand error for forming moment conditions. Finally, ϵ_{ijt} is an iid error term that is type I extreme value distributed.

The coefficients β_i and α_i are individual-specific. They depend on the mean valuations, a vector of i's demographic variables, D_i, and their associated parameters coefficients Φ that measure how preferences vary with demographics; therefore

$$\begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \Phi D_i \tag{2}$$

Consumers who do not purchase any tuna product in a period choose the outside good. The indirect utility of consuming the outside good can be written as $u_{i0t} = \xi_0 + \phi_0 D_i + \epsilon_{i0t}$. Because only differences in utility are identified in discrete-choice models, we normalize ξ_0 to 0.

The vector of demand parameters θ_D consists of a linear part $\theta_1 = (\alpha, \beta)$ that affects each consumers identically, and a nonlinear (random coefficients) part $\theta_2 = \text{vec}(\Phi)$. Analogously, the indirect utility of consuming a product can be decomposed into a mean utility part δ_{jt} and a mean-zero random component $\mu_{ijt} + \epsilon_{ijt}$ capturing heterogeneity from demographics and unobserved taste shocks with $\mu_{ijt} = \delta_{jt}(x_j, p^r_{jt}, \xi_{jt}; \theta_1) + \mu_{ijt}(x_j, p^r_{jt}, D_i; \theta_2)$ with

$$\begin{aligned} \delta_{jt} &= x_j\beta + \alpha p^r_{jt} + \xi_{jt} \\ \mu_{ijt} &= [p^r_{jt}, x_j]' * \Phi D_i, \end{aligned} \tag{3}$$

where $[p^r_{jt}, x_j]$ is a $(K+1) \times 1$ vector of observable product characteristics.

Consumers buy either one unit of a single brand or take the outside good. They choose the option that yields the highest utility. The model's market share predictions are obtained by integrating over all the shock distributions

$$s_{jt}(x_j, p^r_t, \delta_t, \theta_2) = \int_{A_{jt}} dP^*_\epsilon(\epsilon) dP^*_D(D) \tag{4}$$

where $A_{jt}(x_t, p^r_t, \delta_t, \theta_2) = \{(D_i, \epsilon_{it}) | \mu_{ijt} \geq \mu_{ilt} \forall l \in \{0, ..., J\}\}$ denotes the set of consumers' shock realizations for which j yields the highest utility.

3.2 Supply Model

On the supply side, our focus is on modeling the interaction of retailers and manufacturers. Throughout, there is a set G^f_t of producers and a set G^r_t of retailers in market t. The model's predictions for wholesale and retail margins, as well as prices crucially depend on the prevailing firm conduct and the vertical contracts between manufacturers and retailers, see, for example, Villas-Boas (2007); Bonnet and Dubois (2010). In the following, we discuss a wide range of supply specifications that are the basis for our statistical tests and our counterfactuals.

Linear Tariffs

Under linear tariffs retailers and manufacturers interact as in a classical Stackelberg model, in which manufacturers move first and retailers follow. In the second stage, for each market t retailer r maximizes its profit from canned tuna category

$$\Pi^r_t = \max_{\{p^r_{jt}\}_{j \in S^r_t}} \sum_{j \in S^r_t} [p^r_{jt} - p^w_{jt} - c^r_{jt}] s_{jt}(p^r_t) M_t, \tag{5}$$

where M_t is the size of the market, S^r_t is the set of brands sold in market t by retailer r (such that $|\bigcup_r S^r_t| = J_t$) and s_{jt} is the market share of brand j. Retailer r sets the retail price p^r_{jt} considering wholesale prices p^w_t and retail costs c^r_t.

In the first stage, manufacturer f maximizes its profit from market t, which is given by

$$\Pi^f_t = \max_{\{p^w_{jt}\}_{j \in S^f_t}} \sum_{j \in S^f_t} [p^w_{jt} - c^f_{jt}] s_{jt}(p^r_t(p^w_t)) M_t, \tag{6}$$

where S^f_t is the set of brands produced by manufacturer f (such that $|\bigcup_f S^f_t| = J_t - \tilde{J}_t$) and c^f_{jt} is the marginal cost of production.

Two-part Tariffs

Under two-part tariffs manufacturers not only set wholesale prices but also charge a lump sum fee f to retailers. Additionally, we allow for the possibility that manufacturers can use RPM contracts or no-RPM contracts.[9]

Under RPM the retail profit is given by

$$\Pi_t^r = \max_{\{p_{jt}^r\}_{j \in \tilde{S}_t^r}} \sum_{j \in S_t^r} [p_{jt}^r - p_{jt}^w - c_{jt}^r] s_{jt}(p_t^r) M_t, \tag{7}$$

where $\tilde{S}_t^r$ is the set of private label brands sold at retailer r in market t. As there are multiple equilibria in the RPM-models, we will consider a series of different values of p_{jt}^{w*}. Conditional on this equilibrium, manufacturers choose NB retail prices while retailers choose PL prices simultaneously. The manufacturer profit is then determined by

$$\Pi_t^f = \max_{\{p_{jt}^r\}_{j \in S_t^f}} \sum_{j \in S_t^f} [p_{jt}^r - c_{jt}^r - c_{jt}^f] s_{jt}(p_t^r) M_t + \sum_{j \notin S_t^f} [p_{jt}^{r*} - p_{jt}^{w*} - c_{jt}^r] s_{jt}(p_t^r) M_t. \tag{8}$$

In a no-RPM regime, retail profit is identical to the linear pricing case as presented in Equation (5). Manufacturers choose only wholesale prices to maximize their profits given by

$$\Pi_t^f = \max_{\{p_{jt}^w\}_{j \in S_t^f}} \sum_{j \in S_t^f} [p_{jt}^r - c_{jt}^r - c_{jt}^f] s_{jt}(p_t^r) M_t + \sum_{j \notin S_t^f} [p_{jt}^r - p_{jt}^w - c_{jt}^r] s_{jt}(p_t^r) M_t \tag{9}$$

Note that this models does not exhibit multiple equilibria and we assume that manufacturers move first and retailers follow.

3.3 Estimation

In this paper, we do not directly estimate a conduct parameter, as, for example, in Ciliberto and Williams (2014), Miller and Weinberg (2017) or Michel and Weiergraeber (2018). Instead, we employ statistical tests to compare different supply model hypotheses against each other. After having estimated the demand system, the idea is the following: for any hypothesis of retailer and manufacturer behavior, we recover the implied marginal costs. Then, we regress the marginal cost estimates on (exogenous) observable cost shifters, and we compute the cost residuals from this regression. Our statistical tests compare the lack-of-fit associated

[9]Independently of using two-part tariffs with or without RPM, through the modelling approach of Rey and Vergé (2010) (and its empirical implementation in Bonnet and Dubois (2010)), it is possible to incorporate the participation constraint of the retailers into the manufacturers' objective function. As a consequence, manufacturers' internalize fully the total profits of their own brands and only the retail profits of others manufacturers' brands.

with different supply hypotheses based on the different implied vectors of cost residuals. Our strategy is to pairwise test different supply models against each other using non-nested statistical tests (Vuong, 1989; Rivers and Vuong, 2002). An additional advantage of the latter test is that it does not require the competing models to be correctly specified under the null hypothesis.

4 Results and Counterfactuals

This section still requires approval by Kilts-Nielsen.

5 Conclusion and Outlook

In this paper we study the interaction of collusion among NB manufacturers, vertical contracts, and the presence of PL brands in the US canned tuna industry from 2006 to 2016. Using a series of non-nested model tests in the style of Rivers and Vuong (2002) and Bonnet and Dubois (2010) we assess the extent of the canned tuna cartel in several dimensions. Moreover, we find that it is important to carefully consider the nature of the vertical contracts between manufacturers and retailers as well as the strategic pricing of retailers' PL brands in order to correctly assess the damages of a cartel. To the best of our knowledge, these channels have not received a lot of attention neither in academic studies nor in court cases.

References

Babula, R. A. and Corey Jr, R. L. (2004). Us canned tuna supply and demand. *Journal of International Food & Agribusiness Marketing*, **16** (2), 145–164.

Basso, L. J. and Ross, T. W. (2010). Measuring the true harm from price-fixing to both direct and indirect purchasers. *The Journal of Industrial Economics*, **58** (4), 895–927.

Berry, S., Levinsohn, J. and Pakes, A. (1995). Automobile prices in market equilibrium. *Econometrica*, **63** (4), 841–890.

Bonnet, C. and Bouamra-Mechemache, Z. (2019). " yogurt cartel" of private label providers in france: impact on prices and welfare.

— and Dubois, P. (2010). Inference on vertical contracts between manufacturers and retailers allowing for nonlinear pricing and resale price maintenance. *The RAND Journal of Economics*, **41** (1), 139–164.

Boone, J. and Müller, W. (2012). The distribution of harm in price-fixing cases. *International Journal of Industrial Organization*, **30** (2), 265–276.

Chevalier, J. A., Kashyap, A. K. and Rossi, P. E. (2003). Why don't prices rise during periods of peak demand? Evidence from scanner data. *American Economic Review*, **93** (1), 15–37.

Ciliberto, F. and Williams, J. W. (2014). Does multimarket contact facilitate tacit collusion? Inference on conduct parameters in the airline industry. *The RAND Journal of Economics*, **45** (4), 764–791.

Cohen, M. A. and Cotterill, R. W. (2011). Assessing the impact of retailer store brand presence on manufacturer brands in an equilibrium framework. *The Journal of Industrial Economics*, **59** (3), 372–395.

Hansen, K., Singh, V. and Chintagunta, P. (2006). Understanding store-brand purchase behavior across categories. *Marketing Science*, **25** (1), 75–90.

Liu, A.-S. (2007). *Three essays on empirical studies of consumer behavior*. Ph.D. thesis, The University of Texas at Austin.

Meza, S. and Sudhir, K. (2010). Do private labels increase retailer bargaining power? *Quantitative Marketing and Economics*, **8** (3), 333–363.

Michel, C. and Weiergraeber, S. (2018). Estimating firm conduct and long-run demand in the ready-to-eat cereal industry. *mimeo*.

Miller, N. H. and Weinberg, M. C. (2017). Understanding the price effects of the MillerCoors joint venture. *Econometrica*, **85** (6), 1763–1791.

Nevo, A. (2001). Measuring Market Power in the Ready-to-Eat Cereal Industry. *Econometrica*, **69** (2), 307–342.

— and Hatzitaskos, K. (2005). *Why does the average price of tuna fall during Lent?* Tech. rep., National Bureau of Economic Research.

Rey, P. and Vergé, T. (2010). Resale price maintenance and interlocking relationships. *The Journal of Industrial Economics*, **58** (4), 928–961.

Rivers, D. and Vuong, Q. (2002). Model selection tests for nonlinear dynamic models. *The Econometrics Journal*, **5** (1), 1–39.

Sun, C.-H. J., Chiang, F.-S., Owens, M. and Squires, D. (2017). Will american consumers pay more for eco-friendly labeled canned tuna? estimating us consumer demand for canned tuna varieties using scanner data. *Marine Policy*, **79**, 62–69.

Verboven, F. and Dijk, T. v. (2009). Cartel damages claims and the passing-on defense. *The Journal of Industrial Economics*, **57** (3), 457–491.

Villas-Boas, S. B. (2007). Vertical relationships between manufacturers and retailers: Inference with limited data. *The Review of Economic Studies*, **74** (2), 625–652.

Vuong, Q. (1989). Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica*, **57** (2), 307–333.